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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 1, 2015/2016

### HMB 2029 INTRODUCTION TO MOLECULAR CLONING

(All sections / Groups)

15<sup>th</sup> OCTOBER 2015

9:00 – 11:00 am

(2 Hours)

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#### INSTRUCTIONS TO STUDENTS

1. This paper consists of 4 pages with 2 sections including (A) Short Answer Questions and (B) Essay Questions.
2. Section A consists of 4 **short answer questions**. All questions carry equal marks (10 marks per question). Answer **ALL** questions.
3. Section B consists of 3 essay questions. All questions carry equal marks (10 marks per question). Answer **ONLY TWO (2)** questions.
4. Please print all your answers for Section A and B **clearly** and **neatly** in the Answer Booklet provided.

**Section A – SHORT ANSWER QUESTIONS****Answer ALL questions [40 marks]****QUESTION 1**

- a. You want to amplify a stretch of DNA from the following sequence. Design a pair of specific primers for PCR reaction. [2 marks]

DNA sequence

```
5' --GACCTGTGGAAGCTGCAG-----CAGACCCGGCTAGACATG--3'
3' --CTGGACACCTTCGACGTC-----GTCTGGGCCGATCTGTAC--5'
```

- b. What is the purpose of replica plating in colony screening? [2 marks]
- c. Name four basic components used in a typical PCR. [2 marks]
- d. The study of induced pluripotent stem cell hold great promises in medical research field.
- i. What is an induced pluripotent stem cell? [2 marks]
- ii. Why is it considered to be a better option, compared to embryonic stem cell? [2 marks]

**QUESTION 2**

- a. What are the three common features and their functions for a cloning vector? [3 marks]
- b. Ovalbumin is the major protein of egg white. The chicken ovalbumin gene contains eight exons separated by seven introns. Should ovalbumin cDNA or ovalbumin genomic DNA be used to form the protein in *E. coli*? Why? [2 marks]
- c. What is the purpose of using protein tags, such as histidine in expression vector? [2 marks]
- d. Describe briefly the principle of blue white screening in gene cloning. [3 marks]

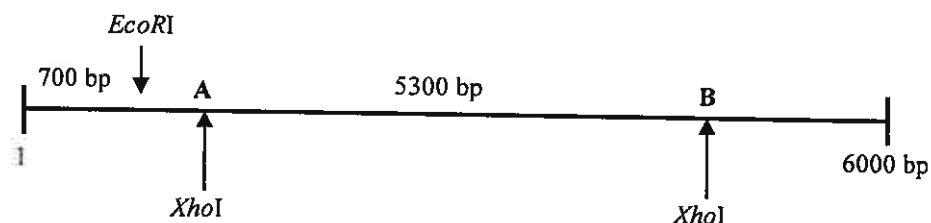
**Continued...**

**QUESTION 3**

- a. What are the main differences between Southern, Northern and Western blots? [3 marks]
- b. Monozygotic twins have very similar genetic contents, yet they may have some differences in phenotypes. Explain briefly this biological phenomenon. [2 marks]
- c. What does codon bias mean? [1 mark]
- d. Name two methods used in the study of protein-protein interaction. [2 marks]
- e. How can two different transcriptomes be studied with a single microarray? [2 marks]

**QUESTION 4**

- a. How can a computer program determine the difference between the stop codon in the intron and the actual stop codon at the end of the exon? [2 marks]
- b. When does haploinsufficiency occur? [2 marks]
- c. You are going to perform a DNA fingerprinting for two individuals, who may be closely related. What loci will you use? Why? [2 marks]
- d. You are studying a virus called RB10, which is known to cause tumors in mice. The genome of RB10 is a linear DNA molecule. To determine the restriction map of RB10, you perform the following complete digests with *XhoI* and *EcoRI*. Suppose the restriction endonuclease *EcoRI* cuts RB10 linear DNA into two fragments; a 700 bp fragment and a 5300 bp fragment. *XhoI* cuts the DNA also into two fragments; fragments 1200 and 4800 bp long. Relative to the *EcoRI* cut site, there are two possible ways in which *XhoI* could have cut the DNA (site A and site B). How can you determine the correct cleavage site (A or B) for *XhoI* with respect to *EcoRI*? [4 marks]

**Continued...**

**Section B – Essay Question****Answer ONLY TWO questions [20 marks]****QUESTION 1**

Genomic and cDNA libraries are created for different purposes. What are genomic and cDNA libraries? Describe the major steps used in generation of genomic and cDNA libraries. What are the differences between these two libraries? [10 marks]

**QUESTION 2**

Discuss the application of the molecular techniques in gene therapy. What factors do we need to consider for this application? [10 marks]

**QUESTION 3**

How can a DNA sequence be searched for regions, which could code for open reading frames and how can these be evaluated in both prokaryotic and eukaryotic organisms? [10 marks]

**End of paper**